

15. (New) The method of claim 7, further comprising the step of feeding water vapor such that an amount of water vapor contained in said reformed gas is from about 24% to about 50% by volume.- -

REMARKS

Claims 1-15 are currently pending in the application.

Several paragraphs of the "Detailed Description of the Invention" section of the specification have been amended to correct typographical and grammatical errors of various words in the specification. The specific changes to the specification appear in the attached Marked-Up Version of the Specification. No new matter has been added by these amendments, and entry is respectfully requested.

Applicants wish to thank the Examiner for the courtesy of the telephone interview granted to Applicants' undersigned attorney and William Schwarze on November 13, 2002. The telephone interview was initiated by the undersigned for the purpose of determining whether a proposed amendment to claim 1 would overcome the Examiner's 35 U.S.C. § 103(a) rejection over United Kingdom Application No. GB 2,240,284 A of Basini *et al.* ("British '284"). Although the Examiner suggested a formal change to proposed claim 1 during the interview, the Examiner stated that he had no problem with the recitation in proposed claim 1 of a source of reformed gas as a way to recite the structure to distinguish the claimed invention from British '284. As such, claim 1 has been amended to include a source of reformed gas containing at least carbon monoxide ("CO"), in addition to hydrogen gas and water vapor, and to further recite that CO is reduced by a shift reaction in the reaction chamber. The Examiner also agreed to the proposal of preparing a conforming amendment to claim 7 and commented that such an amendment would allow him to examine both the apparatus claims (claims 1-6) and the method

claims (claims 7-9) together. The amendments to claims 1 and 7 are supported throughout the specification, including at page 7, lines 14-16; page 9, lines 13-18 and page 10, lines 3-5, for example.

Additionally, Applicants have amended claim 6 to correctly recite that the weight of the elements(s) supported by the carrier is from 0.1 to 0.5 fold and not 0.1 to 0.5%. Support for amending claim 6 can be found, for example, at page 18, lines 4-9 of the specification.

Further, new claims 10-15 have added to recite preferred embodiments described in the specification. Support for adding new claims 10-15 can be found, for example, at page 20, line 21 to page 21, line 22.

No new matter has been added by the amendments and additions to the claims, and entry is respectfully requested.

In the Office Action, the Examiner rejected claims 1-6 under 35 U.S.C. § 103(a) as being unpatentable over United Kingdom Application No. GB 2,240,284 A of Basini *et al.* ("British '284") for the same reasons given in the Office Action dated January 31, 2002 (Paper No. 7). Also, in response to Applicants' Request for Reconsideration dated April 30, 2002, the Examiner contends Applicants' argument that the means for feeding carbon dioxide and light hydrocarbons in British '284 does not read on Applicants' reformed gas feeding part and that the present invention is concerned with treating a reformed gas, whereas British '284 is concerned with producing reformed gas, is not convincing since Applicants' claims do not require the treatment of a reformed gas. In support of this contention, the Examiner asserts that Applicants have not explained why the means for feeding the main reactants comprising carbon dioxide and light hydrocarbons to the reactor of British '284 would not be capable of feeding a reformed gas containing at least a hydrogen gas and water vapor.

The Examiner also asserts in the Office Action that Applicants have not provided evidence showing that the apparatus' structure which would be required by the recitation of a "reformed gas feeding part for feeding a reformed gas containing at least a hydrogen gas and water vapor" would necessarily be any different from the apparatus' structure disclosed in British '284 which is employed for feeding in carbon dioxide and light hydrocarbons to the reactor.

While not necessarily agreeing with the Examiner's rejection, Applicants have amended claim 1 and claim 7, in the manner described above and as shown in the attached Marked-Up Version of the Claims, in order to obviate the rejection. Thus, British '284 is simply a reformed gas production process. British '284 does not teach a source of reformed gas containing CO which is positioned upstream of a CO shifting catalyst body which reduces the CO in the reformed gas by a shift reaction. In view of the forgoing amendments and remarks, including the Examiner's comments during the November 13, 2002 interview, Applicants respectfully submit that claims 1 and 7 comply with the requirements of § 112 and are patentably distinguishable over the prior art.

Further, since claims 2-6 and 8-15 depend, either directly or indirectly, from claims 1 and 7, Applicants submit that these dependent claims are also patentably distinguishable over the prior art. Accordingly, reconsideration and withdrawal of the Examiner's rejection and an early Notice of Allowance of all pending claims is respectfully requested.

Respectfully submitted,

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Marked-Up Version of Specification

The following pages show the specific changes made to the "Detailed Description of the Invention" section of the application as a result of amending the identified paragraphs:

Page 9, line 11 to Page 10, line 2:

--The composition of the reformed gas somewhat changes depending on the temperature of the reforming catalyst body 3a. Usually, in terms of the average composition excepting water vapor, the reformed gas contains about 80% of hydrogen, about 10% of carbon dioxide and about 10% of carbon monoxide. This reformed gas is fed to the CO shifting catalyst body 6a, to cause a reaction of CO with water vapor. Since the Co shifting catalyst body 6a functions at about 150 to 450° C while the reforming catalyst body 3a [is] functions at about 500 to 800° C, the temperature of the reformed gas is controlled to make the temperature of the CO shifting catalyst body 6a optimum by detecting the temperature of the upstream side part of the CO shifting catalyst body 6a with the thermocouple 7 and controlling the output of a cooling [fun] fan attached to the cooler 9 with the temperature controller 8 having feed back mechanism.

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Page 10, lines 3-11:

--The CO concentration of the gas (shifted gas) after passing through the CO shifting catalyst body 6a is about 0.5%. Therefore, after mixing the shifted gas with air containing an oxygen In an amount corresponding to 3-fold of the CO concentration of the shifted gas, the mixed gas is fed to the Co [purufying] purifying catalyst body 11. In the CO purifying catalyst body 11, CO is removed to a level of 10 ppm or less, and the gas is fed through the discharge port 12 to a fuel cell.--

Page 16, lines 17-23:

--Further, when cerium oxide is [complicated] combined with zirconia (Zr), lanthanum (La) and/or zinc (Zn) and the like, lattice failures increase facilitating transfer of oxygen in the lattice. In other words, in an oxide of cerium and Zr, La and/or Zn, oxygen transfers easily. Also, the heat resistance of cerium oxide having relatively low heat resistance can be improved.--

Page 17, lines 5-14:

--As described above, since cerium oxide itself has relatively [lower] low heat resistance, the heat resistance is improved by [complication] combination with Zr. Namely, composite metal oxides containing Ce and Zr are preferable. Also, there is no specific restriction on the method to [complicate] combine cerium oxide with Zr, and there can be used, for example, a co-precipitation method, sol-gel method, alkoxide method and the like. Further, Zr may be incorporated into cerium oxide, or cerium may be incorporated into zirconium oxide.--

Page 17, line 15 to Page 18, line 3:

--Further, when one selected from Pd, Rh and Ru is added in an amount of 0.1 to [0.05-fold] 0.5 fold based on the weight of Pt, further higher activity is obtained. Since these noble metal elements facilitate a methanization reaction, they alone cannot easily obtain higher ability as the CO shifting catalyst, but [complication] combination thereof with Pt can improve the ability of a Pt catalyst. For smooth reaction of CO on the Pt, there needs some active points [remained] remaining on the Pt. However, CO has higher affinity to Pt than the other molecules and tends to close the active points on the Pt. Such tendency is remarkable as the temperature is lower. By adding the slight amount of Pd, Rh and/or Ru, the above-mentioned phenomenon can be inhibited.--

Page 20, lines 4-15:

--Further, when the amount of water vapor contained in a reformed gas is from 24 to 50% by volume, particularly high activity is obtained. It is more preferable from the equilibrium point of view when the average content of water vapor in the reformed gas [s] is higher, and specifically, the CO concentration fully decreases when water vapor is contained in an amount of 24% by volume or more. On the other hand, when the water vapor content increases, the flow rate increases causing a disadvantage in the reaction rate, and specifically, when the content is more than 50% by volume, the CO concentration cannot be decreased sufficiently.

Marked-Up Version of the Claims

- -1. (Amended) A hydrogen refinement apparatus comprising a [reformed gas feeding part for feeding a] source of reformed gas containing at least a hydrogen gas, carbon monoxide and water vapor, and a reaction chamber equipped with a carbon monoxide shifting catalyst body positioned downstream from said reformed gas source [feeding part],

wherein said carbon monoxide shifting catalyst body [comprising] comprises a carrier composed of at least one metal oxide having a BET specific surface area of at least 10 m²/g [or more] and Pt supported thereon, such that carbon monoxide in said reformed gas is capable of being reduced by a shift reaction in said reaction chamber.

6. (Amended) A hydrogen refinement apparatus in accordance with claim 1, wherein said carbon monoxide shifting catalyst body comprises a carrier supporting Pd, Rh or Ru in an amount of 0.1 to 0.5[%] fold by weight based on Pt, in addition to Pt.

7. (Amended) A method for operating a hydrogen refinement apparatus comprising a [reformed gas feeding part for feeding a] source of reformed gas containing at least a hydrogen gas, carbon monoxide, and water vapor and a reaction chamber equipped with a carbon monoxide shifting catalyst body positioned downstream from said reformed gas source [feeding part]; said carbon monoxide shifting catalyst body comprising a carrier composed of at least one metal oxide having a BET specific surface area of at least $10 \text{ m}^2/\text{g}$ [or more] and Pt supported thereon,

comprising the [step] steps of controlling the temperature of said carbon monoxide shifting catalyst body from 150 to 450 °C and reducing carbon monoxide in said reformed gas by a shift reaction in said reaction chamber.- -